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(54) Docking system for a self-propelled working tool

(57) A docking system (1) according to the invention comprises

a) at least one self-propelled working-tool (3), preferably intended for attendance of ground or floor, such as grass-cutting, moss-scratching, watering, vacuum-cleaning, polishing, transportation etc., having a body (16) and
b) at least one docking station (2) for the at least one working tool (3),
c) wherein the docking station and the tool can by way of emitted signals establish contact with each other, so that the tool can drive up to the docking station,
d) wherein the docking station is provided with at least one first transmission part (5, 6; 5', 6') and the working tool is provided with at least one cooperating second transmission part (7, 8) for transmission of energy and/or information between the docking station and the working tool,
e) wherein the docking station is provided with at least one rising part (10, 11, 12, 13), of which at least one part is used for mounting of the first transmission part(s).
f) wherein the tool's second transmission part(s) (7, 8) is/are located on the upper side of the body.

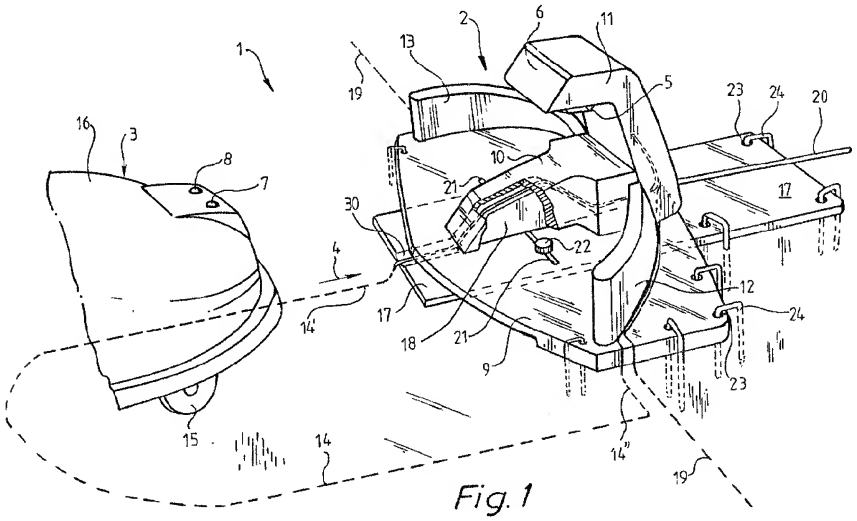


Fig. 1

EP 1 302 147 A1

Description

Technical field

[0001] The subject invention refers to a docking system.

Background of the invention

[0002] The idea to create a working tool, which manage completely by itself, such as a robot lawn mover or a robot vacuum-cleaner, is old, but has been difficult to realize. The solar cell driven lawn mover, called Solar Mower, is however an example of such kind of product. It cuts the grass within a border cable, which has been placed in order to fence off the cutting area. Preferably the border cable is buried into the ground. A signal generator feeds the border cable with current, whose magnetic field affects a sensing unit on the working tool. Since the working tool is driven by solar cell energy it is reduced to work with very low power, only slightly more than 10 watt. This means that the maximum ground area which the working tool could manage to cut will be limited. Furthermore, the solar cell operation as well as the demand for low power consumption lead to a relatively complicated and expensive design.

[0003] An immediate idea would be to create a battery-powered cutting machine, which should be connected manually for recharging its batteries. This would enable a simpler cutting machine, however, at the same time the big advantage of having a fully automatic grass cutting machine would disappear. Obviously, the same also applies for a battery-powered vacuum-cleaner. Docking stations for recharging of battery-powered, loop-controlled trucks are probably known. The design of such kind of docking system is essentially facilitated by the fact that the docking procedure takes place on even floors.

[0004] *US 5 324 948 A* discloses a docking system which comprises an autonomous mobile robot for radiological surveys and a docking station at which the robot's battery can be recharged. The robot is guided to the docking station by means of an infrared beam emitted by the docking station and detected by the robot. The docking station is provided with a charging prong extending horizontally, which cooperates with a socket on the robot facing outwardly in a horizontal direction. The direction in which the charging prong is inserted into the socket is, thus, the same as the direction of the robot approaching the docking station. The docking station comprises an earth metal base plate intended to be placed on the ground or a floor, and a rising part on which the charging prong is mounted. In the docked position the robot rests on the base plate.

[0005] *US 5 440 216 A* discloses a docking system comprising a robot floor cleaner and a docking station for recharging the robot's battery. The robot is guided to the vicinity of the docking station by ultrasonic waves emitted by the station. Accurate docking is then achieved by magnets and magnetic sensors mounted on both the robot and the docking station. A direct-current applying plug on the docking station engages a charging receptacle on the robot in horizontal direction. The docking station comprises a base plate and a rising part on which the charging plug is mounted. In the docking manoeuvre the robot rides with its wheels up on the docking station base plate.

Purpose of the invention

[0006] The purpose of the subject invention is to create a docking system, which is protected from dirt.

Summary of the invention

[0007] The above purpose is achieved in a docking system in accordance with the invention having the characteristics appearing from the appended claims.

[0008] The docking system according to claim 1 essentially comprises at least one docking station for at least one self-propelled working tool, and includes the working tool itself, preferably intended for attendance of ground or floor, such as grass-cutting, moss-scratching, watering vacuum-cleaning, polishing, transportation etc., wherein the docking station and the tool can by way of emitted signals establish contact with each other, so that the tool can drive up to the docking station, and the docking station is provided with at least one first transmission part for transmission of energy and/or information between the docking station and the tool, which is provided with at least one cooperating second transmission part.

[0009] Now, the transmission part(s) of the working tool(s) is/are arranged on the upper side of the tool's body. Thus, the transmission part(s) are protected from dirt.

[0010] It is understood and explicitly declared that any subject-matter contained in the PCT application PCT/SE98/02456 with the designation EP (EP 98 965 939.6), which this application is a divisional application of, and not claimed by the claims of EP 98 965 939.6 in the version of the rule 51 (4) communication or the granted version shall be subject-matter of this divisional application and can therefore also be claimed.

[0011] Preferred embodiments are claimed in the dependent claims referring back to claim 1.

[0012] Usually the docking station is designed as or provided with a base plate, intended to be placed on ground or floor.

[0013] The transmission part(s) of the docking station preferably face(s) downwards and the transmission part (s) of the working tool face(s) upwards. In this embodiment, the transmission part(s) of the docking station is or are particularly weather-protected.

[0014] In another embodiment, the transmission part (s) face(s) sideways or perpendicular to the docking di-

rection, in particular parallel with the base plate.

[0015] In an advantageous embodiment the transmission part(s) of the tool is/are arranged in the front of the body, in particular on the opposite side of the rear wheels, and/or adjacent the middle of the body.

[0016] Preferably the docking station is so adapted that the tool with any part, such as wheel/s or body, can drive up on the docking station. Since the tool can drive up on the docking station with any part it is assured that the tool will end up in a sufficiently exact position in relation to the transmission part/s. In case the docking station shall be placed on a lawn or another rough ground, this matter of fact is extremely important.

[0017] In a preferred embodiment of the invention contact between the tool and the docking station is established by way of a first cable, called search cable. Its one connection leads to the station in a docking direction, so that the tool can drive up to the station in the desired docking direction.

[0018] Furthermore, the transmission parts of the docking station as well as the working tool are preferably adapted for transmitting electric energy between the docking station and the tool.

[0019] These and other characteristics and advantages of the invention will become more apparent from the detailed description of various embodiments with the support of the annexed drawing.

Brief description of the drawing

[0020] The invention will be described in closer detail in the following by way of various embodiments thereof with reference to the annexed drawing.

[0021] Figure 1 shows in perspective a working tool, such as a lawn mover placed on a lawn, on its way towards a docking station. Only the front part of the tool is illustrated.

[0022] Figure 2 shows in perspective how the tool has driven up and taken up a docking position at the docking station.

[0023] Figure 3 shows the tool and the docking station seen from the side in the same position as in figure 2. From the figure it becomes evident that the transmission parts of the tool and the station have established contact with each other.

[0024] Figure 4 illustrates in a detailed enlargement the established contact between the transmission parts. The transmission part of the station has a somewhat different design in figure 4 than in figure 3.

Description of the preferred embodiments

[0025] In figure 1 numeral reference 1 designates a docking system in accordance with the invention. It comprises a docking station 2 and a working tool 3, and to a certain extent these are adapted to each other. However, the system could also include one docking station and several working tools, or several docking stations and one or several working tools.

[0026] The working tool 3 is self-propelled and has a number of wheels 15, usually four or three wheels, or, two wheels with complementary supporting points. In the shown embodiment as becomes apparent from the figures 1-3, the tool has two large rear wheels and two smaller self-adjusting link wheels as front wheels. The rear wheel's rotational speed and rotational direction are individually controlled by way of a microprocessor. In this manner the tool can drive forwards or backwards and turn in different desirable directions. Obviously the tool could also have one front link wheel and possibly steerable front wheels and synchronously driven rear wheels.

[0027] The tool 3 is equipped with a body 16 and another two transmission parts 7, 8 are located on the upper side of the body far forwards and adjacent the middle of the body, seen in a lateral view. This location is advantageous considering the fact that the inclination of the ground under the docking station and the tool's wheels, especially its rear wheels, can vary. This location of the transmission parts is also suitable considering possible dirtying of the tool.

[0028] The transmission parts 7, 8 are intended to cooperate with the first transmission parts 5, 6, which are located in the docking station. The transmission parts of the tool and the station are in the illustrated case adapted for transmitting electric energy between the docking station and the tool in connection with charging, or possibly discharging, of an electric accumulator, located in the tool. The accumulator is not shown in any figure. For this transmission is preferably used at least two first transmission parts 5, 6 of the docking station, and at least two second transmission parts 7, 8 of the working tool.

[0029] Normally, the docking station is thus used for transmitting electric energy for battery-charging, but also other kinds of transmission are possible, e.g. information could be transmitted from the station on to the tool or vice versa by way of further transmission parts, or, by way of the existing ones, so that these can transfer both electric energy and electric information. It could be a matter of transmission of data, but also transmission of simple mechanical information, such as the tool informs that "I am now on the spot", by pushing a button. Furthermore, transmission parts for energy in form of petrol or other power fuels are also conceivable. And of course there can be transmission parts for energy both in form of different fuels and in form of electric power.

[0030] The docking station is mainly composed of a base plate 9, which is provided with at least one rising part.

[0031] For, it is preferable to place the first transmissions parts 5, 6 of the docking station higher up than the base plate 9 itself.

[0032] Moreover, preferably they should be turned downwards in order to cooperate with the second transmission parts of the tool, which are turned upwards.

[0033] An example of this is the embodiment shown in the drawing figures. It is particularly preferable considering the risk of dirtying of the tool, and also as weather-protection for the transmissions parts of the docking station. The first transmission parts 5, 6; 5', 6' of the docking station are placed in a rising part 11, called transmission head 11, which is placed higher up than the base plate 9 and a possible ramp 10. The transmission head 11 rises up over the front part of the tool when the tool is in the docking position. The transmission head is mounted either directly to the base plate or onto a possible ramp 10, which also rises up from the base plate.

[0034] As appears from the figure there is a bottom plate 17. A first connection 14' of search cable 14 is led over the top of this bottom plate. The base plate 9 and the bottom plate 17 are laterally displaceable in relation to each other. This enables a desirable adjustment of the docking procedure. This adjustment is advantageous but not completely necessary. It means that plate 17 could be excluded. In that case the search cable 14 is instead drawn on the ground under the base plate.

[0035] A part rising from the base plate is shaped like a ramp 10, which in a direction from the outer surrounding part of the docking station and inwards rises higher and higher up from the base plate in order to cooperate with the tool's body, in that the ramp forces its way underneath the body making it rise when the tool moves forwards. The ramp in accordance with the shown embodiment is intended for a docking system with only one docking direction 4. When the tool moves forwards the ramp extends under the mid part of the body, and the lower edge of the body gets into contact with the ramp and slides up along this so that the tool's front wheels lose contact with the ground. This becomes apparent by comparing with the final docking position according to figure 3. It means that the tool's front end is supported against the ramp approximately at the mid part of the tool in its sideways direction.

[0036] At the same time, the second transmission parts 7, 8 are placed at the upper side of the tool and far forward. It means that the transmission parts are located in a longitudinal direction adjacent the part of the tool's lower edge which cooperates with the ramp. This is advantageous when the ground under the tool and the docking station is rough. A rising or lowering of the tool's rear end in relation to the ideal position as shown in figure 3 would not affect the contact between the transmission parts of the tool and those of the docking station very much. The same applies if the tool's rear end is angled in relation to the shown ideal position in figure 3, i.e. if for example a rear wheel is raised in relation to the other rear wheel. Since the body is supported at its own mid part in its sideways direction, and the transmission parts are located at the mid part of the body, such an angling will have the least possible influence on the contact between the different transmission parts.

[0037] The ramp could be shaped so that it protrudes like a point. Its upper side inclines upwards in the docking direction and causes the tool's body to rise when the tool is moving forwards. The ramp can cooperate with the body in many different ways, preferably at the mid part of the body, in its sideways direction, it could e.g. protrude through an aperture in the body. In this manner the transmission parts of the tool, usually electric contacts, can have a safe placement inside the aperture and be directed optionally, and they could also be resilient. Preferably the transmission parts of the docking station are then placed on one or several sides of the protruding ramp.

[0038] However, the docking system could also be designed for a number of docking directions. Nearest to think of might be a double docking station with a second docking direction, which is quite the opposite one to the docking direction 4. In this case a second search cable could be connected in the opposite direction and a possible ramp should be arranged in the opposite direction to the shown one. A second transmission head 11 should point towards the opposite direction.

[0039] However, it might also be possible to design the docking station for still more docking directions and the docking procedure does not have to follow the search cable's one connection into the docking station. The docking station could for instance emit signals of a suitable wavelength within a sector from the station. The radial range does not have to be especially long and it is an advantage if it is limited considering any disturbances of other equipment. In such a case contact should be established without any search cable at all and the tool should move towards the docking station. This could then occur in a very large number of conceivable docking directions within a sector. Obviously in such a case the ramp 10 should have an angular extension that corresponds to the utilized sector. Furthermore the transmission parts of the docking station as well as the tool should be adapted for a number of various docking directions, e.g. a resilient centre contact, corresponding to the transmission part 5, could operate with the transmission part 7, while an exterior ring or sectorial resilient contact, corresponding to the transmission part 6, could cooperate with the transmission part 8. Consequently, the docking station will have at least two transmission parts 5, 6 in the form of resilient contacts 5, 6, for transmission of electric energy.

[0040] The first and the second transmission parts 5-8 of the docking station and the tool could thus preferably be turned sideways, i.e. in parallel with the base plate 9. They could for instance be composed of resilient contacts located on the outside of the ramp, which cooperates with the contacts 7, 8 located under the body 16. If the ramp should be slotted the contacts 5, 6 could be placed inside the ramp and cooperate with the contacts 7, 8, which are located on a holder, which extends through the slot when the tool is docking. Obviously the contacts 5, 6 could also be located in the transmission

head 11, but turned sideways, e.g. they could be resilient and turned sideways towards the mid part of the transmission head. This is of course on condition that the contacts 7, 8 of the tool are located on a rising part and turned outwards from each other to be able to cooperate with the contacts 5, 6. The shown location of the contacts in the tool, i.e. laterally beside each other, is advantageous in many respects. But obviously they could also be placed in a longitudinal direction with or without any lateral displacement. In the latter case the rear contact should then be placed higher up than the front one in order to enable contact with one contact 5, 6 each of the docking station. Obviously the contacts 7, 8 of the tool could also be placed on a more vertical surface forwards, at the same time as the cooperating contacts 5, 6 of the docking station are placed on a vertical surface of the transmission head 11.

[0041] Preferably the resilient contacts are formed as resilient tin-plates 5, 6. This becomes apparent from figure 3. The resilient tin-plates could be large in width in order to decrease the demand for an elaborate docking operation. For example, they could be 60 mm broad each. A big advantage with resilient tin-plates is that they are not exposed to friction between any sliding parts. In this manner they do not run the risk of getting stuck in a suspended position, so that the transmission function is at risk.

[0042] Figure 4 shows a partial enlargement of an alternative tin-plate 5'. It is arranged with a marked bend 28 adjacent to its own mid part. The other tin-plate 6' is hidden in the figure, but has a corresponding marked bend 29 adjacent to its own mid part. By way of this bend the force direction between the contacts 5', 7 and 6', 8 respectively will change. In means that the contacts can create a certain retaining force on the tool 3. This is of great value for a tool whose driving wheels are not locked during docking, e.g. if the drive engines are very smooth-running even when the current is switched off. The resilient contacts 5, 6 are of course preferably located in the docking station since this is stationary and these contact are easier to protect than the contacts 7, 8 in the tool. The protective cover the transmission head is provided which could of course be pulled further downwards at the sides in order to protect the contacts 5, 6; 5', 6' against wind and weather as well as unintentional finger contact etc.

[0043] However, at the same time the voltage of the contacts is very low, only about 20 V, so a contact with the live parts shouldn't mean any danger either for human beings or animals. Obviously, the transmission head 11 could also be provided with a protective cover, which then must be pushed away by the tool 3 when docking.

[0044] In the preferred embodiment the tool follows a search cable's 14 first connection 14', which leads to the station in a docking direction 4. The tool follows the search cable 14 in that a sensing unit 27, see figure 3, is placed into the tool and detects the magnetic field from the electric signals, which are emitted to the search cable. However, the magnetic field is also affected by other electric signals emitted by electric equipment as well as earth magnetism and iron objects. As a rule also a second cable 19 is used, called border cable. Into this cable electric signals are sent from the docking station. The border cable is used to fence off the cutting area as well as that area the tool should stay within. The mentioned disturbances implies that it would be suitable to make a certain adjustment of the docking sideways. This could be facilitated by that the first connection 14' is led above a bottom plate 17. This is laterally displaceable in relation to the base plate 9.

[0045] In practical use the bottom plate 17 will be placed on the ground in the desirable way, so that the first connection 14' can be led into a cable groove 30 at the bottom plate. The first connection 14' is thus resting on the bottom plate from where it leads to a signal generator, which usually is located in the transmission head 11, however, it could also be located somewhere else. The bottom plate 17 is preferably fastened by a number of cramps 24, which are inserted through apertures in the bottom plate. Thereafter the base plate 9 with its rising parts is placed on top of the bottom plate 17. The both plates are joined together by a number of mounting screws 22, which pass down through slots 21, and are fastened onto the bottom plate 17. These mounting screws could be fastened only slightly in order to make a docking test. In case the tool is not docking in a proper way, i.e. so that the transmission parts 5, 6 and 7, 8 respectively are corresponding to each other laterally, the base plate 9 will be displaced in the suitable direction and the tests will be repeated until the result is satisfactory. Thereafter the mounting screws are tightened and the base plate 9 is fastened with a number of cramps 24 penetrating through aperture 23 in the base plate 9. The cramps 24 are U-shaped in order to provide a particularly satisfactory mounting. In the shown embodiment the whole base plate 9 is thus movable in relation to the search cable's first connection 14' in order to enable the desirable adjustment.

[0046] However, this adjustment could be made in many different ways and nor is the bottom plate 17 required, e.g. the first connection 14' could be led above the base plate 9 under a possible ramp 10. In that case the transmission head 11 could have a displaceable mounting either onto the ramp 10 or onto the base plate 9 itself. Also, it could be firmly mounted onto the ramp 10, which in turn could be laterally displaceable on the base plate 9. This is provided that any screening parts 12, 13 do not reach all the way up to the ramp 10, but enables the desirable adjustment.

[0047] The search cable's 14 first connection 14' is led through or under the docking station along the docking direction 4 at least a certain distance. The length of this distance depends on how far forwards or backwards the sensing unit 27 is located in the tool 3. The adjustability sideways, i.e. essentially perpendicularly to the docking

direction, should be arranged between the first connection 14' of the search cable and the first transmission part 6; 5', 6'.

[0048] In figure 1 it is shown how the first connection 14' is led over a protrusion 18, which protrudes inside the ramp 10 and is laterally displaceable. Preferably the protrusion 18 is mounted to the bottom plate 17, but it could also be arranged to be movable inside the ramp in other ways, e.g. the protrusion 18 could be laterally movable by means of adjusting screws which are put through the sides of the ramp. Owing to the fact that the ramp and the base plate are partly cut up the protrusion 18 becomes more apparent. The base plate 9 is preferably designed as a moulded plastic plate, in which possible rising parts, such as the ramp 10 and the screening parts 12, 13, are formed directly into the material. It means that there are large cavities inside the ramp as well as the screening parts.

[0049] The first connection 14' could also be led into a cable groove above the base plate 9 und up the ramp 10. It could also be mounted on the underside of the ramp 10. As for the two last-mentioned embodiments it is preferable assumed that the transmission head 11 is laterally adjustable. The basic principle for the rising of the search cable is that the search cable's 14 first connection 14' is led through or under the docking station along the docking direction 4 at least a certain distance, and over some part of this distance the first connection is arranged to be raised above the level of the base plate 9 in order to allow the tool to follow the cable more precisely when docking. As becomes apparent from figures 3, due to this rising of the first connection 14' it will come considerably closer to the sensing unit 27 and hereby a more careful following of the cable can be achieved.

[0050] Preferably the docking system according to the invention should be co-operating with an electronic bordering system according to Swedish patent application 9703399-7 (see also WO 99/15941 A1). The border cable 19 separates the ground area and is shown here on a substantially reduced scale from considerations of space. A signal generator feeds the border cable 19 with current containing at least two components of alternating-current with different frequency, and the components are lying in a known relation of time to each other. Hereby a control unit in the tool can evaluate the difference in signals from the sensing unit 27, caused by the magnetic field's different directions in the inner area A from the outer area C. It means that the tool can separate the inner area A from the outer area C and keep within the inner area A. By way of the search cable 14 a special area, called search area B, is created. This area B is located within the inner area A. Preferably the signal generator feeds the search cable 14 with the same current containing at least two alternating-current components. During some part of the time the current in the both cables 19 and 14 are lying in phase with each other, but during some part of the time the relation of time will change so that they are lying out of phase with each other. If the time proportions for phase and anti-phase between the cables are given a value differing from 50/50 % the average of the picked up signals in the sensing unit 27 can be distinguished between area A and area B. Particularly suitable proportions between the phase and anti-phase times might be one quarter and three quarters or vice versa. Accordingly, by this system the areas A, B and C can be separated. The system functions so that the control unit separates the different areas and not each cable 14, 19, as such.

[0051] The tool 3, usually a lawn mower, usually operates on the principle of random motion within the area A. When its battery charge begins to run down it reacts in a special way when passing from area A to area B, or vice versa. The control unit takes note of the passage from area A to area B and the tool turns left with the intension of following the search cable 14 in a clockwise direction towards the docking station 2. In the opposite case, i.e. passage from area B to area A, the tool instead turns right with the intension of following the search cable in a clockwise direction. After this initial turn the tool will change over to a "follow the cable" mode as follows. After the tool has passed from area B over to area A it turns immediately towards the opposite direction and moves back to area B and after moving from area A to area B it turns again and moves towards area A. This pattern will be repeated very frequently. The zigzag motion over the search cable 14 is hardly visible on a lawn, but the result will be that the cutting tool will follow the search cable 14 in the desirable direction clockwise, so that it arrives at the docking station in the docking direction 4. Obviously the search cable 14 shall lie in the docking direction 4, at least the adjacent part outside the docking station 2. Hereby is assured that the tool moves straight towards the station. Furthermore, the search cable is drawn over the station a suitable length, i.e. the first connection 14', so that the tool follows the first connection 14' up to the docking position. Since the tool is able to separate area A from area B it can also follow the search cable 14 in the desirable direction up to the station.

[0052] Obviously the search cable could as well be followed in an anti-clockwise direction, provided that the anti-clockwise connection 14" instead is drawn in the desirable docking direction 4. Furthermore, it might also be possible for the tool to stand still within the area B during a certain time of the day and night. The tool's microprocessor with a built-in clock is then simply being programmed to stop within the area B when the tool arrives there during the relevant time. Consequently, the above described electronic search system does not imply any docking system, even if docking is the most common application. Obviously the search system could also be combined with other docking systems than the above described.

[0053] Because the tool operates at random it will thus push into the docking station 2 from different directions. For, it is only when the accumulator have to be re-

charged that the tool will follow the docking direction 4 up to the docking station. Preferably the base plate 9 is therefore provided with at least one screening part 12, 13, which protrudes from the base plate and has a height adapted to the tool so that it at least locally is higher than the height of the lower edge of the tool's body, so that the screening part/s together with the rising parts, which also are higher than the lower edge of the body, will prevent the tool from driving up to the first transmission part 5, 6 of the docking station in other docking directions than the intended ones.

[0054] The tool is so designed that when it runs into a firm object it will reverse. This occurs when it runs into the outer surfaces of the screening parts 12, 13 as well as the transmission head 11. For, by way of the electronic bordering system the tool can drive outside the border cable 19 by approximately three decimetres. Owing to this the docking station 2 can be reached by the tool from the side or obliquely from behind. Since the tool will push into the docking station its anchorage is important. This can also be made by substantial ballasting of the station; or by glueing onto a floor, or fastening with double-adherent tape etc. As becomes evident from the figure the cables 14 and 19 are drawn under ground except when they lead over the docking station 2. The second connection 14" of the search cable, as well as one connection of border cable 19, are drawn along the screening part 12, which protect the cables from damage. The cables are led up to the signal generator which is located in the transmission head 11.

Claims

1. A docking system (1) which essentially comprises

   a) at least one self-propelled working-tool (3), preferably intended for attendance of ground or floor, such as grass-cutting, moss-scratching, watering, vacuum-cleaning, polishing, transportation etc., having a body (16) and
   b) at least one docking station (2) for the at least one working tool (3),
   c) wherein the docking station and the tool can by way of emitted signals establish contact with each other, so that the tool can drive up to the docking station,
   d) wherein the docking station is provided with at least one first transmission part (5, 6; 5', 6') and the working tool is provided with at least one cooperating second transmission part (7, 8) for transmission of energy and/or information between the docking station and the working tool,
   e) wherein the docking station is provided with at least one rising part (10, 11, 12, 13), of which at least one part is used for mounting of the first transmission part(s).
   f) wherein the tool's second transmission part (s) (7, 8) is/are located on the upper side of the body.

2. A docking system (1) according to claim 1, wherein electric signals are sent out from the docking station into at least one first cable (14), called search cable (14), and each cable's first connection (14') respectively leads to the station in a docking direction (4).

3. A docking system (1) according to claim 1 or 2, wherein at least two first transmission parts (5, 6) of the docking station, and at least two second transmission parts (7, 8) of the working tool are adapted for transmission of electric energy between the docking station and the tool in connection with recharging, or possibly discharging, of an electric accumulator located in the tool.

4. A docking system (1) in accordance with any one of the preceding claims, wherein the docking station is so adapted that the tool with any part, such as wheel/s (15) or body (16) can drive up on the docking station.

5. A docking system (1) according to any one of the preceding claims, wherein the docking station is designed as or provided with a base plate (9), intended to be placed on ground or floor.

6. A docking system (1) according to claim 5, wherein the docking station's first transmissions part(s) is/are located in a rising part (11), called transmission head (11), which is located higher up than the base plate (9).

7. A docking system according to any of the proceeding claims, wherein the docking station's first transmission part/s (5, 6; 5', 6') is/are turned downwards, and the tool's second transmission part/s (7, 8) is/are turned upwards.

8. A docking system (1) according to any of the preceding claims, wherein the docking station's and the tool's first and second transmission parts (5-8) are turned sideways, in particular parallel with the base plate (9).

9. A docking system (1) according to claim 3 or any claim referring back to claim 3, wherein the docking station has at least two transmission parts (5, 6) for transmission of electric energy arranged in form of resilient contacts (5, 6), in particular in form of resilient tin-plates (5, 6), preferably arranged with a marked bend (28, 29) adjacent to their own mid part.

10. A docking system according to any of the preceding claims, wherein at least two first transmission parts

and at least two second transmission parts are provided, the two first or second transmission part being arranged laterally beside each other.

11. A docking system (1) according to claim 2 or any claim referring back to claim 2, wherein the search cable's (14) first connection (14') is led through or under the station along the docking direction (4) at least a certain distance, and in that an adjustability sideways, i.e. perpendicularly towards the docking direction, is arranged between the first connection (14') of the search cable (14) and the first transmission part (5, 6; 5', 6').

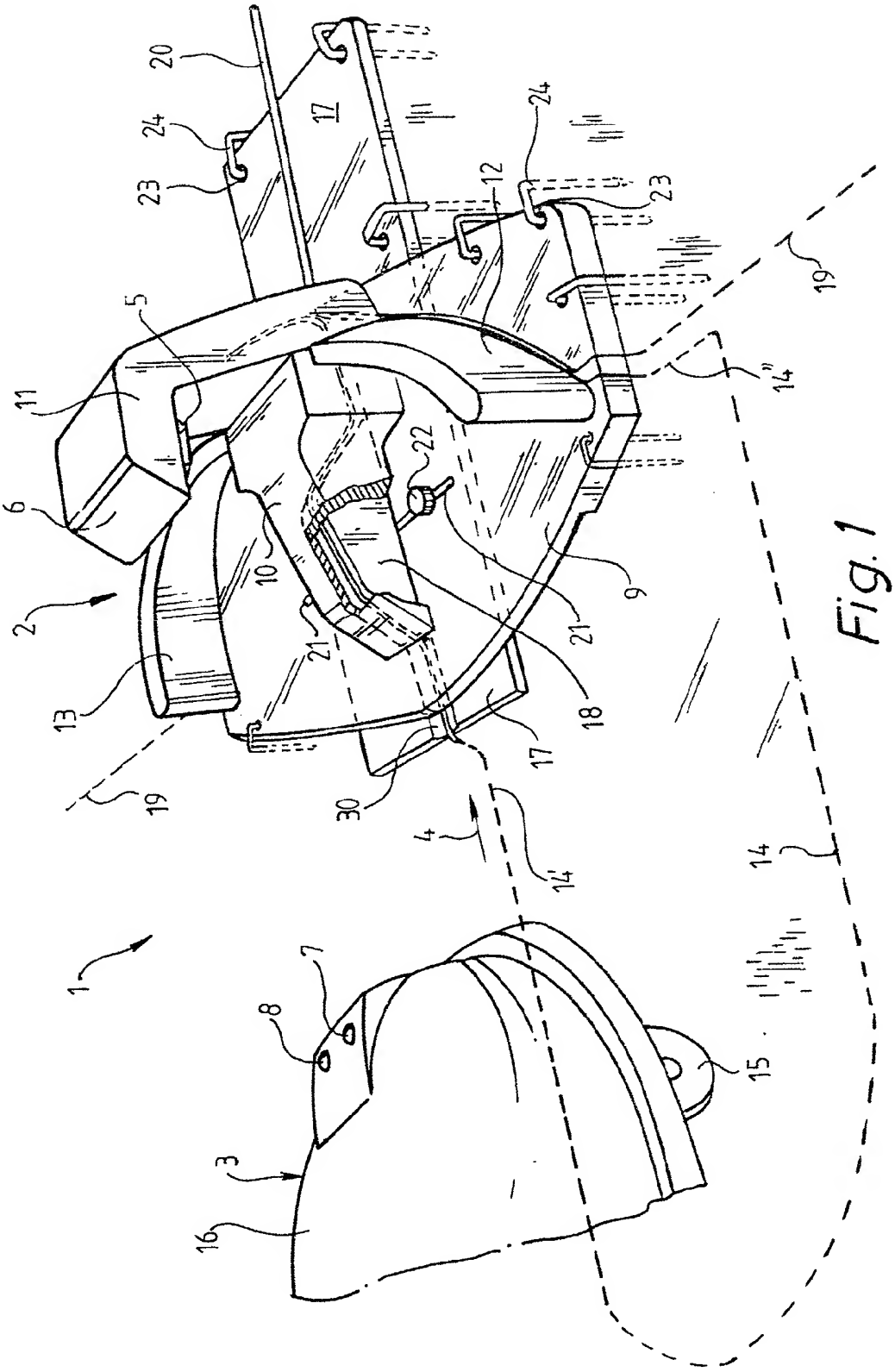
12. A docking system (1) according to claim 11, wherein the search cable's (14) first connection (14') is led above a bottom plate (17), which to the most part is arranged under the base plate (9), which in turn is laterally displaceable in relation to the bottom plate.

13. A docking system (1) according to any one of the preceding claims, wherein the search cable's (14) first connection (14') is led through or under the station along the docking direction (4) at least a certain distance, and over some part of this distance the first connection is arranged to be raised above the level of the base plate (9), in order to allow the tool to follow the cable more precisely when docking.

14. A docking system (1) according to any one of the preceding claims, wherein electric signals are sent out from the docking station into a second cable (1), called border cable (19).

15. A docking system (1) according to any one of the preceding claims, referring back to claim 5, wherein the base plate (9) is provided with at least one screening part (12, 13), which protrudes from the base plate and has a height adapted to the tool so that it is at least locally higher than the height of the lower edge of the tool's body, so that the screening part/s together with the rising parts, which also are higher than the lower edge of the body, will prevent the tool from driving up to the first transmission part (5, 6) of the docking station in other directions than the intended docking directions.

16. A docking system according to any of the preceding claims, wherein the second transmission part(s) of the tool are located far forward on the upper side of body and/or adjacent to the middle of the body.


20
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23
19
5
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14"
6
22
10
9
2
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30
4
14'
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1
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8
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3
16

Fig. 1

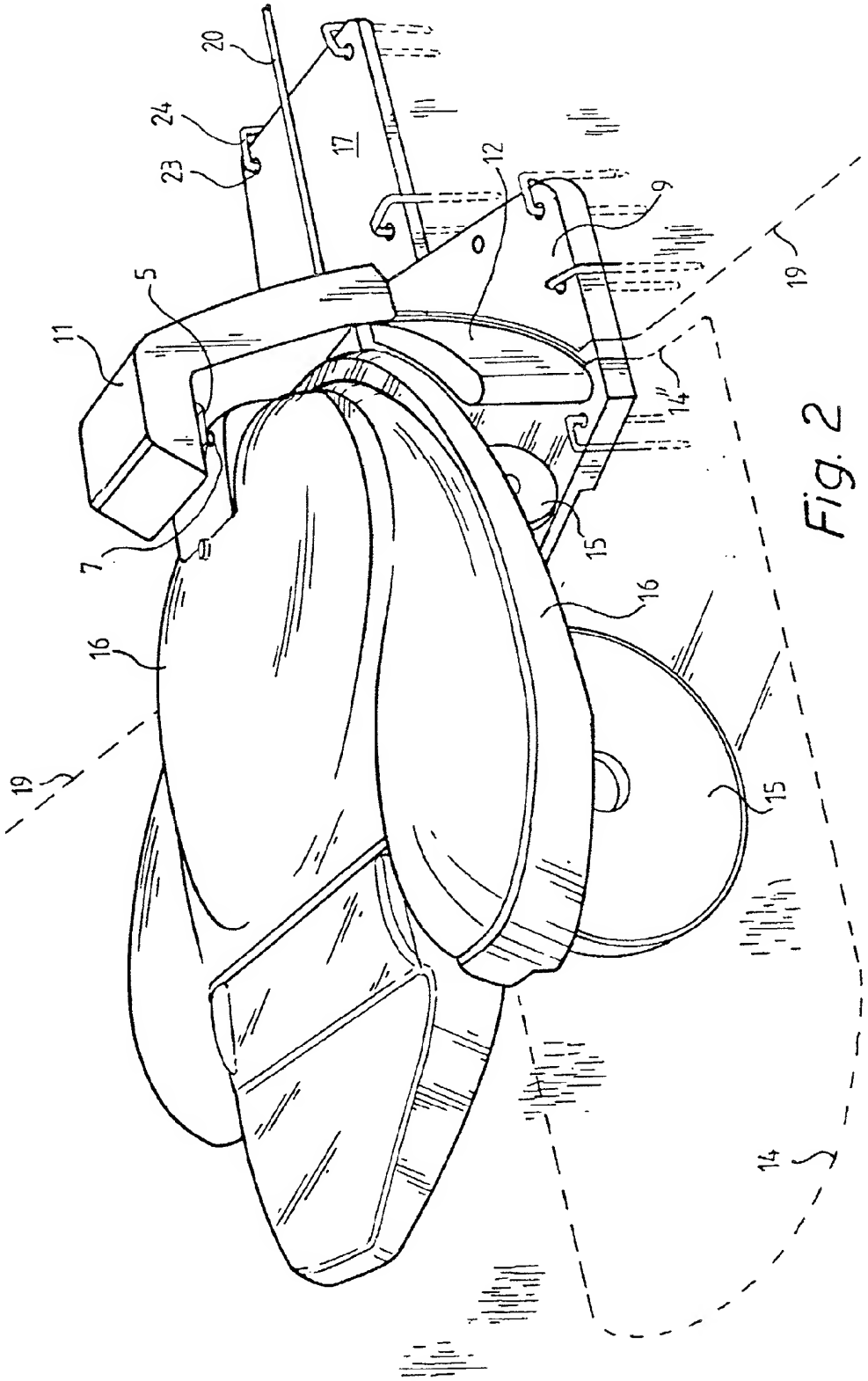


Fig. 2

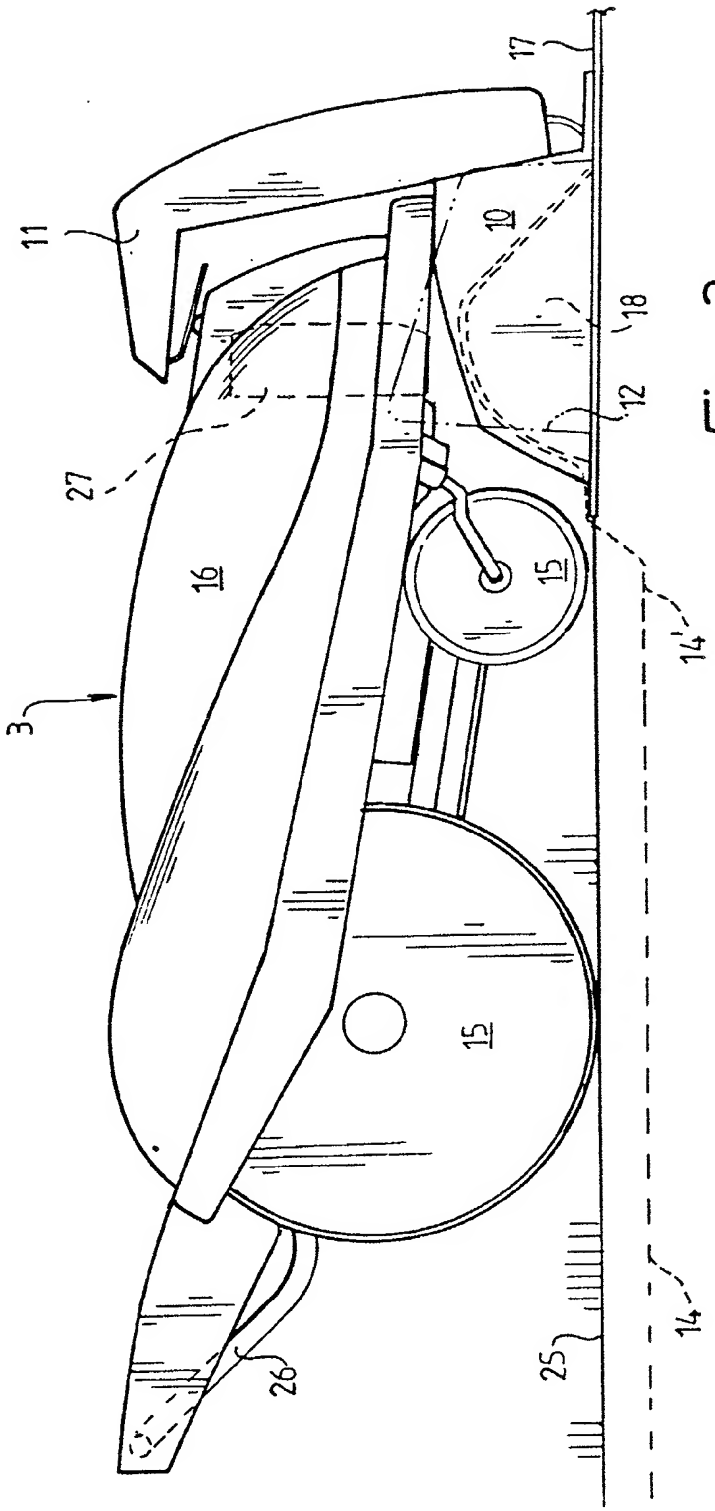
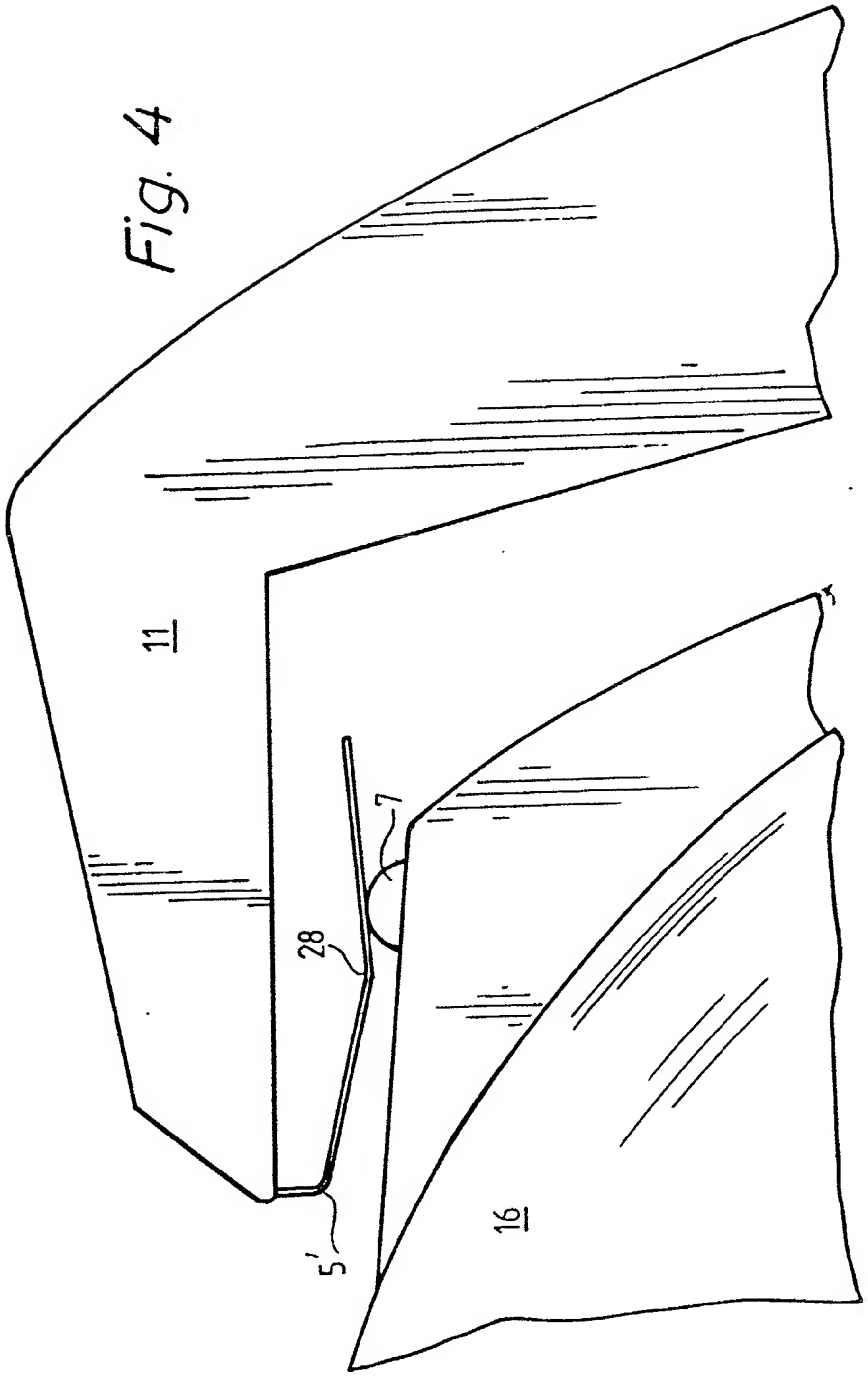


Fig. 3

Fig. 4



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Application Number
EP 02 07 7337

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A47L
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	26 November 2002	Laue, F

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